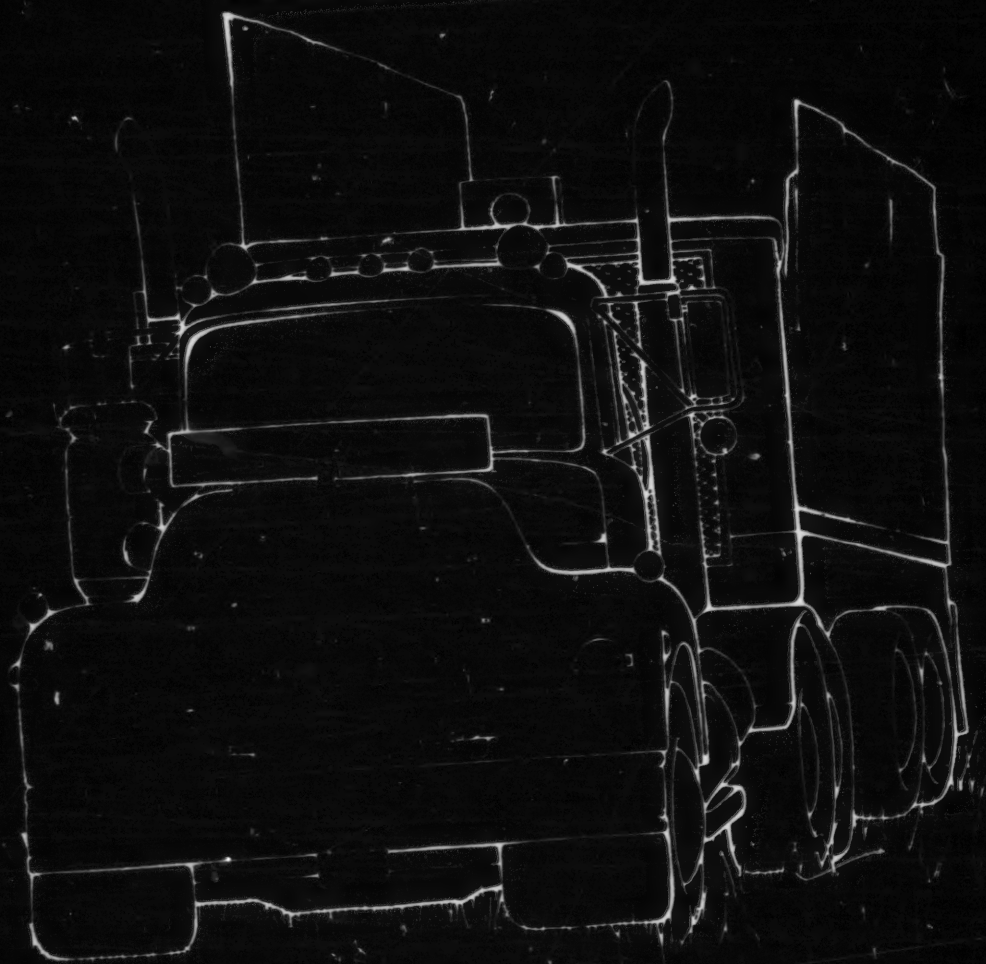
ENERGY USE FOR FARM TRUCKING IN ALBERTA



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Alberta Agriculture

June, 1983

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SECTION I

INTRODUCTION

Energy is one of the most important input factors in agriculture. It is required for farm operations such as tillage, seeding, harvesting, and transportation of farm products and supplies. Agriculture is also heavily dependent on the indirect use of energy in the manufacture of fertilizer, pesticides, machinery and other inputs.

Future development and expansion of the agriculture industry will require adequate and dependable energy supplies throughout the food sector. Farmers in western Canada are particularly vulnerable to energy supply disruptions because their crop production operations require large fuel inputs over short periods of time. They are also particularly dependent on mobile fuels (usually gasoline and diesel), with little opportunity to shift to other energy sources.

Farm production is a central part of the food system. Farm trucks serve in transporting production inputs to farms and outputs to processing, distribution and consumption centers. Besides farm uses, there is a considerable amount of non-farm or personal use of these trucks. It has been estimated that more than 50 per cent of the gasoline used by farmers is consumed in cars and trucks. Farmers also use energy in other mobile agricultural equipment such as tractors, swathers and combines.

World and Canadian energy prices, and particularly petroleum prices, have increased dramatically in the last decade. Although the rate of increase in world petroleum prices has slowed in 1983, Canada's National Energy Program has continued to bring our energy prices toward the higher level of world prices.

The national and international energy market outlook is now very unsettled. World petroleum demand has dropped and the Organization of Petroleum Exporting Countries has encountered increasing difficultly in controlling supplies and prices on the world market. At the present time, the possibility exists that Canada's National Energy Program will be renegotiated to take into account falling world oil prices, with consequent changes in future Canadian energy prices.

In view of the importance of energy in agriculture, efforts are needed to develop comprehensive and accurate information on energy supply and demand. While farm trucking is only one part of the food system, it serves an important function. Energy shortages or price increases in one part of the system can disrupt the flow of products. It is hoped that the information presented in this study will serve as a benchmark for, and tie in with, future investigations of energy use in other parts of the food system.

A. Objectives of the Study

The overall objective of this study is to describe the use of energy (fuel) by farm trucks for farm and non-farm operations. Additional specific objectives are:

1. To describe the characteristics of farm trucks in Alberta.
2. To estimate the relative magnitude of energy costs in relation to total farm trucking costs and total energy costs on Alberta farms.
3. To estimate and describe the use of commercial trucking for farm inputs and products.

B. Sample Selection

Data for this study were obtained by questionnaire mailed to farm truck owners. This questionnaire appears in the Appendix of this report. The sample for the study was randomly selected from the list of all owners of registered farm vehicles in Alberta in 1981. Since vehicles other than trucks can be registered as farm vehicles, it is likely that some people to whom questionnaires were mailed were not truck owners. These people were among the non-respondents in this study. It is also possible that people receiving questionnaires owned more than one truck. In these cases they were asked to provide information on all of their trucks.

C. Collection of Data

The pre-tested questionnaire used in this study was mailed to 900 farmers throughout the province during the first half of February, 1982. The number of useable responses returned were 201, or 22.3 per cent of the original sample size. Although this rate was low, it was considered to be adequate for analytical purposes. Moreover, missing data did not appear to be a serious problem among the returned questionnaires.

The regional distribution of the completed questionnaires was as follows:

Table 1 Regional Distribution of Survey Responses

	Region*	No. of Useable Responses	Percent
I	Southern	52	26
II	South-Central	28	14
III	North-Central	36	18
IV	North-West	21	10
V	North-East	38	19
VI	Peace River	26	13
	Total	201	100

* These regions are shown in Figure 1.

Respondents were given the opportunity to supply information in either imperial or metric units. The results in this study are reported in metric units, with imperial units given in brackets in some cases.

D. Enterprise Classification

The questionnaire used in this study asked respondents to indicate their major farm enterprise or enterprises. The figures in Table 2 show the reported enterprise breakdown. Since 58 per cent of the respondents indicated more than one major enterprise, the results shown here total more than 100 per cent.

Figure 1

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REGIONS

Table 2 Enterprise Distribution of Respondents

Enterprise	No. of Respondents	% of Respondents
Grains and oilseeds	162	81
Forages	54	27
Special crops	11	5
Cattle	106	53
Dairy	16	8
Hogs	30	15
Poultry	7	3
Other	2	1

SECTION II

GENERAL CHARACTERISTICS OF FARM TRUCKS

A. Number of Farm Trucks

In 1980-81 there were 161,900 farm vehicles registered with the Alberta Motor Vehicles Branch. By 1982-83 this number had risen to 184,300 of which 179,200 were trucks. The 1981 Canadian Census of Agriculture, however, reported 123,800 trucks on 52,549 census farms in Alberta. The census figure may be lower than those from the Motor Vehicle Branch since it excluded registered farm trucks having annual sales of $250 or more, which are not on census farms.

The 201 respondents in this study reported 671 owned trucks. The average number of trucks per farm was therefore 3.45, as compared with the census average of 2.36 trucks per farm. The larger average number of trucks per farm reported for the present study may reflect a slight response bias toward larger farms with larger equipment investments.

There was also considerable variation between farms and between regions in the number of trucks per farm reported for this study. The breakdown of trucks per farm is shown in Table 3.

Table 3 Number of Trucks per Farm

No. of Trucks on Farm	No. of Respondents	Percent of Respondents
1	11	6
2	62	31
3	44	22
4	33	16
5	44	22

In addition to the above breakdown, one respondent each reported the following numbers of trucks per farm: 7, 8, 9, 10, 11, 13, and 17.

The average number of trucks per farm ranged from 2.8 in Region IV (North West) to 4.2 in Region I (Southern).

B. Farm Truck Weights

Respondents were asked to report the gross vehicle weight of each of their trucks. The figures in Table 4 show the weight distribution from both the survey results and from Alberta Motor Vehicle Branch registrations.

Truck size and weight are often referred to in "ton" designations, particularly for small and mid-size trucks. Some of the common sizes and correponding gross vehicle weight are as follows:

"1/2 ton" or "5/8 ton" : 2100 - 2800 kg GVW

"3/4 ton" : 2800 - 4000 kg GVW

"1 ton" : 3900 - 4700 kg GVW

These gross vehicle weight ranges show some of the variation between makes and between standard and heavy duty models.

Table 4 Weight Distribution and Fuel Type, Farm Trucks

Weight Class (kg)	Reported in Present Study		All Registered
	Gasoline (%)	Diesel (%)	Farm Vehicles (%)
0 - 2,000	4.9	0	2.8
2,001 - 3,000	23.2	19.4	21.8
3,001 - 4,000	10.6	5.6	19.0
4,001 - 5,000	7.3	0	17.2
5,001 - 6,000	1.6	0	8.5
6,001 - 7,000	1.3	5.6	3.6
7,001 - 8,000	1.1	0	3.9
8,001 - 9,000	1.1	2.8	1.1
9,001 - 10,000	3.0	5.6	1.2
10,001 - 12,000	7.0	0	4.6
12,001 - 14,000	15.3	2.8	11.7
more than 14,000	8.7	50.0	4.5
not reported	14.9	8.2	
TOTAL	100.0	100.0	100.0

The weight categories shown above are used throughout this report since vehicle weight is correlated with such things as the use to which the truck is put and the cost of its operation. The total number of gasoline trucks reported in this study was 632 and the number of diesel trucks was 36. Three trucks had an unreported fuel type.

C. Age of Farm Trucks

There is a wide range of ages of farm trucks in use in Alberta. Information was collected for this study on both the model year and the year of purchase for all reported trucks. Alberta Motor Vehicle Branch records also list model year for registered farm vehicles. These results are shown in Table 5.

Table 5 Model Year and Year of Purchase of Farm Trucks

Model Year	Sample (%)	All Registered Farm Vehicles (%)
1960 and earlier	7.6	5.4
1961 - 65	6.7	6.5
1966 - 70	14.9	14.0
1971 - 75	26.1	24.4
1976 - 80	32.2	39.8
1981 - 82	4.9	9.9
not reported	7.6	

Year Purchased	Sample (%)
1960 and earlier	2.4
1961 - 65	3.1
1966 - 70	7.9
1971 - 75	21.8
1976 - 80	50.0
1981 - 82	10.9
not reported	3.9

The above figures indicate that more than 50 per cent of the farm trucks in use in Alberta are 1975 model year or older, whereas only 35 per cent of these trucks were purchased in 1975 or before. A comparison of the model year and year of purchase above gives a rough indication of the relative importance of used farm trucks in Alberta. It was determined that 57 per cent of the trucks reported in this study were purchased used.

D. Use of Farm Trucks

Farm trucks are put to a variety of uses, including the hauling of supplies and products. The results in Table 6 show the average percentage of annual mileage (distance driven) for particular purposes, within vehicle weight classes.

Table 6 Use of Farm Trucks: Per Cent of Annual Mileage

Weight Class (kg)	Hauling				Other Non-Farm
	Crops	Livestock	Farm Supplies	Custom	
0 - 2,000	10.4	9.8	71.6	0	8.2
2,001- 3,000	10.9	10.3	62.7	0.5	15.6
3,001- 4,000	16.2	11.9	64.1	0.1	7.7
4,001- 5,000	47.7	10.3	32.5	0.5	9.0
5,001- 6,000	51.7	5.2	34.6	0	8.5
6,001- 7,000	46.8	22.6	27.8	0	2.8
7,001- 8,000	62.1	8.6	29.3	0	0
8,001- 9,000	75.6	10.6	13.8	0	0
9,001-10,000	66.0	17.7	15.3	1.0	0
10,001-12,000	68.8	10.9	18.9	0.1	1.3
12,001-14,000	74.6	14.3	9.6	0.5	1.0
more than 14,000	79.3	6.5	13.4	0	0.8

These figures show some clear, weight - related patterns of use of farm trucks. As vehicle weight increases there is a corresponding increase in the use of trucks for hauling crops. The relative cost efficiency of various vehicle sizes is discussed later in this report.

The hauling of farm supplies shows the reverse pattern; lighter trucks are used proportionately more. Farm supplies are commonly purchased in small quantities which can be handled by smaller trucks, or are purchased in bulk and then often hauled by larger, commercial trucks, as in the case of fuel and feed.

Livestock hauling does not appear to be correlated with vehicle weight. Custom hauling is a very minor activity and other non-farm uses appear to be unimportant for trucks over 6000 kg. Trucks of lighter weight may often be used in place of an automobile for non-farm purposes.

There may be some under-reporting of mileage in the custom hauling and other non-farm categories related to the use of purple gas. Respondents were not asked about the use of purple gas.

SECTION III

FUEL USE IN FARM TRUCKING

A. Fuel Efficiency

Farming is very dependent on liquid petroleum fuels, such as gasoline and diesel, because of its extensive use of mobile equipment. Although Alberta Motor Vehicle Branch records are incomplete with respect to the type of fuel used by registered farm vehicles, 97 per cent of the vehicles are reported to use gasoline, 3 per cent use diesel and an insignificant number use other fuels such as propane. The results of this study were similar: 94 per cent of the farm trucks use gasoline, 5.8 per cent use diesel and 0.2 per cent use other fuels.

One of the factors which determine the demand for farm truck fuel is the fuel efficiency (litres per 100 km or miles per gallon) of such vehicles.* Respondents were asked to report the fuel efficiency of each of their trucks. The figures in Table 7 show the average results by gross weight class for trucks using gasoline. Because of the small number of diesel trucks reported at less than 14,000 kg, it was not meaningful to report average fuel efficiency by weight class for these.

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* $\frac{L}{(100\ km)} = \frac{282.5}{MPG}$

Table 7 Gasoline Fuel Efficiency by Gross Vehicle Weight

Gross Weight Class (kg)	Litres per 100 km	Miles per gallon
0- 2,000	17.3	16.3
2,001- 3,000	18.8	15.0
3,001- 4,000	22.2	12.7
4,001- 5,000	25.5	11.1
5,001- 6,000	22.8	12.4
6,001- 7,000	26.2	10.8
7,001- 8,000	25.7	11.0
8,001- 9,000	37.2	7.6
9,001-10,000	31.7	8.9
10,001-12,000	32.1	8.8
12,001-14,000	41.5	6.8
more than 14,000	44.1	6.4

These figures show an expected higher fuel efficiency at lower vehicle weights. This pattern would be offset or reversed, however, if efficiency were measured in terms of fuel consumption and payload (eg. litres per tonne per kilometre). The calculation of payload efficiency has not been undertaken here however, since much of the necessary information is unavailable. Actual payload efficiency would be affected by a variety of factors such as payload capacity, the type of tires used, and the average proportion of the payload capacity used.

The average fuel efficiency for all diesel trucks reported in this study was 21.9 L/100 km (12.9 mpg). For the 18 diesel trucks in the over 14,000 kg gross weight class which reported fuel efficiency, the average was 40 L/100 km (7 mpg).

Another perspective on the fuel efficiency of farm trucks is provided by examining the change which has taken place over time. Table 8 shows the relationship between model year and fuel efficiency.

Table 8 Model Year and Fuel Efficiency, in Per Cent*

	Fuel Efficiency					
Litres/100 km	more than 69	31-69	20-30	15-19	less than 15	
MPG	less than 5	5-9	10-14	15-19	more than 19	TOTAL
Model Year						
1955 and older	5.4	24.3	39.2	23.0	8.1	100
1956 - 1960	0	14.3	64.3	7.1	14.3	100
1961 - 1965	13.3	51.1	24.4	6.7	4.5	100
1966 - 1970	11.0	33.0	30.0	17.0	9.0	100
1971 - 1975	8.5	35.4	32.6	20.6	2.9	100
1976 - 1977	1.2	27.2	46.9	19.8	4.9	100
1978 - 1979	9.7	25.3	24.1	34.9	6.0	100
1980 - 1982	7.1	11.9	28.6	36.9	15.5	100

* Includes both gasoline and diesel trucks

By comparing the rows in Table 8 it can be seen that there has been some improvement over time in the fuel efficiency of farm trucks, particularly in the last 5 years. Approximately 50 per cent of the 1980-82 model trucks were reported to use less than 19 litres per 100 km (more than 15 miles per gallon), whereas the older categories generally show 20-30 per cent with this fuel efficiency.

There are a number of factors which may contribute to this trend in fuel efficiency. Newer trucks usually have smaller than average size, engines, are in better mechanical repair, and most of them have radial tires.

B. Average Annual Mileage

In addition to fuel efficiency, the major factors affecting total fuel demand for farm trucking is the annual mileage and the number of farm trucks. Respondents were asked to report the average annual mileage for each of their trucks.

Table 9 shows the average reported mileage for trucks using gasoline.

Table 9 Average Annual Mileage by Weight Class (Trucks Using Gasoline)

Gross Weight (kg)	Average Annual Driving Distance (km)	Gross Weight (kg)	Average Annual Driving Distance (km)
0-2,000	14800	7,001- 8,000	13300
2,001-3,000	14500	8,001- 9,000	7100
3,001-4,000	17700	9,001-10,000	6200
4,001-5,000	12600	10,001-12,000	7800
5,001-6,000	13700	12,001-14,000	8000
6,001-7,000	6200	more than 14,000	8700

The average annual distance driven by all reported diesel trucks was 14900 km.

C. Reported and Estimated Farm Fuel Consumption

A provincial fuel cost reduction program, called the Alberta Farm Fuel Distribution Allowance, has been in operation since 1974. Under this allowance farmers are charged reduced prices for marked ("purple") gasoline and diesel to be used for farm purposes. Table 10 shows the quantities of marked gasoline and diesel reported to have been sold since 1975.

Table 10 Sales of Marked Gasoline and Diesel, in Alberta

Fiscal Year	Marked Gasoline	Marked Diesel
	(million litres)	
1975/76	533.7	268.2
1977/78	562.8	319.1
1978/79	535.0	324.6
1979/80	508.2	345.7
1980/81	515.2	371.5

Source: Unpublished data, Alberta Farm Fuel Distribution Allowance.

The consumption of marked gasoline increased up to 1977/78, with a generally consistent decline after that point. Marked diesel, on the other hand, has continued to increase throughout this period, showing a 39 per cent increase over the 5 year period. This trend likely indicates a continuing shift toward diesel powered farm equipment. (Jensen Engineering, p. 18). It should be remembered that the figures in Table 10 show sales of marked gasoline and diesel to all farm equipment. Sales of unmarked ("orange") gasoline to farms, mainly for automobile use, would be in addition to the quantities in Table 10.

In order to estimate total fuel consumption by farm trucks, it is necessary to know the number of trucks using each type of fuel. Although, as mentioned earlier, the Motor Vehicle Branch records are incomplete with respect to fuel type, it is possible to estimate the distribution of trucks by gross weight class and fuel type by using the ratio between fuel types mentioned at the beginning of Section III of this report. These estimated truck numbers can then be combined with average reported fuel efficiency and average annual driving distance. The total 1981-82 consumption derived in this manner is 460 million litres of gasoline and 27 million litres of diesel fuel.

To compare these two figures with those shown in Table 10, the consumption of unmarked fuel by farm trucks would have to be subtracted, and the amount of marked fuel consumed by other farm equipment (tractors, combines, swathers, etc.) would have to be added to the two figures shown here. Also, the figures in Table 10 would have to be updated to 1981/82. Although the necessary information for these comparisons and calculations is unavailable, it appears that the estimated 460 million litres consumption of gasoline by farm trucks is somewhat too high, while the 27 million litres of diesel may be an underestimate. These figures represent 89 per cent and 7 per cent respectively of the recorded total farm gasoline and diesel consumption levels for 1980/81 shown in Table 10.

D. On-Farm Use of Farm Trucks

Respondents were asked in this survey to report the average annual distance driven on their farms (off public roads) for each of their

trucks. These reported distances were compared with the total reported annual driving distance for each truck. Of the total trucks reported, 73 per cent had less than 20 per cent of their annual driving distance on farms, 13 per cent had 20 to 40 per cent of their driving distance on farms, and 14 per cent drove 60 per cent or more on farms. These figures were reasonably consistent across weight classes, with a somewhat higher reported on-farm usage of trucks in the 8,000 to 12,000 kg range.

SECTION IV

FARM TRUCKING COSTS

A. Demand For Farm Truck Fuel

According to economic theory, the amount of fuel demanded for farm trucking is expected to vary inversely with the price of fuel, particularly in the long run. A number of other factors also affect the demand for fuel, including the demand for farm trucking, the availibility and cost of substitutes, and the potential for fuel conservation in trucking (including the time required to depreciate existing trucks and purchase more efficient models). Variations in these factors will affect the demand for fuel at each price level.

An analysis of the demand for farm truck fuel would provide important information on the expected response of farmers to fuel price changes. It might show, for example, that a sharp change in the price of fuel would have little effect on the quantity demanded in the short run, but a significant effect on farm costs and net returns. The information provided by this survey was insufficient to allow a formal analysis of the demand for farm truck fuel. It did, however permit an investigation of two factors affecting the nature of that demand. These factors were the relative share of fuel costs in total farm trucking costs, and the use of commercial trucking by farmers (discussed in Section V).

B. Cost Components for Farm Trucking

Respondents to this survey reported the average annual cost of license, insurance, fuel, maintenance and repairs, and other costs for each of their trucks. In addition to these reported costs, depreciation and interest costs were calculated using reported information on vehicle age and purchase price. Table 11 shows average cost components broken down by gross weight category for trucks using gasoline.

Table 11 Average Annual Trucking Costs, By Gross Vehicle Weight (Gasoline Trucks)

Gross Weight (kg)	License ($)	Insurance ($)	Fuel ($)	Maintenance and Repairs ($)
0- 2,000	27	144	774	274
2,001- 3,000	24	115	835	367
3,001- 4,000	27	130	1047	455
4,001- 5,000	29	136	776	434
5,001- 6,000	35	249	931	321
6,001- 7,000	23	88	555	270
7,001- 8,000	31	91	542	265
8,001- 9,000	32	74	622	504
9,001-10,000	29	53	335	157
10,001-12,000	30	73	706	312
12,001-14,000	37	143	1154	487
more than 14,000	34	117	1213	769

Table 11 continued

Gross Weight (kg)	Depreciation ($)	Interest ($)	Other ($)	Total Costs ($)	Total Costs per km ($)
	dollars				
0- 2,000	481	449	45	2194	0.15
2,001- 3,000	537	502	48	2428	0.17
3,001- 4,000	597	558	11	2825	0.16
4,001- 5,000	629	587	33	2624	0.21
5,001- 6,000	962	898	20	3416	0.25
6,001- 7,000	685	640	0	2261	0.36
7,001- 8,000	362	338	0	1629	0.12
8,001- 9,000	203	190	0	1625	0.23
9,001-10,000	195	182	0	951	0.15
10,001-12,000	371	345	25	1862	0.24
12,001-14,000	894	835	23	3573	0.45
more than 14,000	967	903	39	4042	0.46

License costs do not vary much between weight classes for farm trucks. The small variation shown in Table 11 is due mainly to the presence of some unlicensed trucks or trucks with other types of licenses in some of the weight categories. Overall, 97 per cent of the gasoline powered trucks reported in this survey carried farm licenses.

Insurance costs reported in Table 11 are larger and more variable than license costs. The low insurance costs reported for trucks between 6,000 and 12,000 kg are likely due to the higher reported use on farms in this mid-weight range and the smaller number of trucks reported.

Depreciation costs for farm trucks are fixed costs. For trucks purchased before 1981, depreciation was calculated in this study at 15 per cent of book value. The book value was, in turn, calculated by:

Book value = (Reported purchase price) x (0.85) x (age)

where age = 1980 - year of purchase + 0.5. Assuming truck purchases are evenly distributed throughout the year, the average age at year end is 0.5 years.

Interest charges were calculated at 14 per cent of book value. This interest rate was selected as being representative at the time this study was conducted, though it is recognized that actual interest charges paid by farm truck owners vary considerably and that many trucks are owned under clear title and therefore interest costs do not involve a cash payment.

Depreciation and interest costs for trucks purchased in 1981 were calculated at one half of the respective annual rates.

Table 11 also shows the total operating costs per kilometre, calculated by dividing the estimated total costs by the average annual mileage for each weight category (Table 9). The results show a general increase in total cost per kilometre from the lower to higher weight categories, aside from some anomalies in the 7,000 to 12,000 kg weight range. These may be related to problems of statistical estimation due to the low number of trucks reported in this weight range.

The average operating costs for diesel trucks over 14,000 kg gross vehicle weight are shown below. Table 4 indicated that this weight class represented 50 per cent of all reported diesel trucks.

Table 12 Average Annual Trucking Costs, Diesel Trucks over 14,000 kg

License	$ 42
Insurance	$ 132
Fuel	$1391
Maintenance and Repairs	$1123
Depreciation	$2672
Interest	$2494
Other Costs	$ 6
Total Costs	$7860
Total Costs per km	$ 0.78

A comparison of the total costs per kilometre in Tables 11 and 12 shows that the cost of operating diesel trucks over 14,000 kg is significantly higher than for similar sized gasoline trucks. This is due to the high depreciation and interest costs which result from higher purchase prices for diesel trucks. The average purchase price of gasoline trucks in this weight range was $12,000 while for diesel it was $28,000. The average fuel cost per kilometre was similar between the two fuel types for those over 14,000 kg weight class ($0.14 per kilometre). While the overall fuel efficiency of diesel trucks was higher than that of gasoline trucks in this survey, the efficiency in the over 14,000 kg weight class was similar for the two fuel types: 44 and 40 litres per 100 kilometres for gasoline and diesel, respectively (6.4 and 7 miles per gallon). It is recognized that these results do not agree with the expectation that diesel engines are more energy efficient than gasoline engines (Jensen Engineering, p. 52). This may be due to the small sample size available here or to the fact that fuel efficiencies were estimated by respondents. The figures in Table 13 give a somewhat different perspective on diesel and gasoline fuel efficiency.

As mentioned earlier, the proportion of total trucking costs accounted for by fuel will likely be related to the nature of the demand for farm truck fuel. The larger this proportion is, the greater the

impact of fuel price changes on the quantity of fuel demanded, other factors being equal.

Table 13 shows average fuel costs as a percentage of total operating costs and as a percentage of total costs less depreciation and interest.

Table 13 Fuel Costs as Percentage of Total Costs and Total Operating Costs of Farm Truck

Weight Class (kg)	% of Total Costs	% of Total Operating Costs (less dep. & int.)
Gasoline		
0- 2,000	35	61
2,001- 3,000	34	60
3,001- 4,000	37	63
4,001- 5,000	30	55
5,001- 6,000	27	60
6,001- 7,000	25	59
7,001- 8,000	33	58
8,001- 9,000	38	51
9,001-10,000	35	58
10,001-12,000	38	62
12,001-14,000	32	63
more than 14,000	30	56
Diesel		
more than 14,000	18	52

The figures in Table 13 indicate that fuel costs make up a significant proportion of the costs (particularly the cash or variable costs) of farm truck operation. The proportion of cash costs accounted for by fuel is fairly consistent between the weight categories and fuel types shown in Table 13. The information in this table suggests that for farm trucks in general the price of fuel will have a significant effect on the demand for fuel, at least in the long run. As the price of fuel rises, farmers will have considerable incentive to look for conservation techniques or for substitutes for farm trucking. To the extent that commercial trucking is more fuel efficient, there would be an incentive to make greater use of that type of service.

The farm truck operator's ability to conserve fuel will be determined by a variety of factors such as the average payload carried, the maintenance of the truck, the use of radial tires, and the opportunity to purchase and operate vehicles with higher fuel efficiency. Some of these factors can be brought into effect with little delay. Others, such as purchasing of fuel efficient models, will be delayed by the remaining useful life of the existing vehicles. In the short run, before fuel conservation measures can be fully implemented, fuel price increases will have a significant effect on farm costs and net returns.

SECTION V

COMMERCIAL TRUCKING

As mentioned in Section IV, two factors which affect the demand for farm truck fuel were examined in this study. One of these was the proportion of total trucking costs accounted for by fuel cost. The larger this proportion is, the greater the impact on net farm revenue in the short run, and the greater the incentive in the long run to conserve fuel.

The other major factor affecting the demand for farm truck fuel is the availibility of commercial trucking or custom hauling services. Where commercial trucking is available and where it provides a more fuel efficient form of transportation, it will serve as an economic substitute for farm trucking. The availability of substitutes makes the demand for a product such as fuel more flexible or responsive to price. Provided that the cost of commercial trucking is not directly correlated with the cost of farm truck fuel, the demand for commercial trucking will tend to rise as the price of farm fuel rises.

Table 14 shows the regional use of commercial trucking reported by respondents to this survey.

Table 14 Use of Commercial Trucks, by Region

Region	Use	Do Not Use	No Response
I Southern	25	24	3
II South-Central	15	13	0
III North-Central	20	16	0
IV North-East	11	9	1
V North-West	18	18	2
VI Peace River	7	16	3
Total respondents	96	96	9

Although the numbers are small, it appears that in all areas except Region VI (Peace River) approximately half of all farms use commercial trucks. This proportion could, in fact, be somewhat higher since respondents were not asked specifically to include commercial hauling of inputs, including such things as fuel.

Table 15 shows similar information on the use of commercial trucks, broken down by major farm enterprise types. The totals in Table 15 are greater than those in Table 14 since respondents could indicate more than one major enterprise.

Table 15 Use of Commercial Trucking, by Major Enterprise

Enterprise	Use	Do Not Use	No Response
Grains and oilseed	72	85	5
Forage	33	18	3
Special crops	5	6	0
Cattle	62	43	1
Dairy	12	4	0
Hogs	15	14	1
Poultry	5	2	0
Other	2	0	0

As with the geographical breakdown, it appears that for most of the enterprise groups approximately half the producers use commercial trucks. In the categories of forage, cattle and dairy production, however, the proportion of respondents using commercial trucks is higher. This is to be expected in the case of dairy producers where milk is collected by special tank trucks usually operated by the purchasing dairy. Where specialized equipment, such as for transporting fuel, is required, it is generally impractical or uneconomical for the farmer to do his own trucking. In these cases commercial trucking is often supplied by a purchaser or input supplier and is not a close substitute for farm trucking. Changes in the cost of the commercial trucking service or the cost of farm trucking will not usually cause a shift from one mode to the other.

Respondents who indicated that they use commercial trucking were asked to state what products they shipped in this way. The major products were cattle (48 respondents) grains and oilseeds (36) and forage and feed (9). Thirteen respondents said they shipped livestock (likely cattle and hogs) by commercial haulers. Other product groups had smaller response rates and many who reported they used this type of service did not indicate what products were involved.

The information presented in Table 14 and 15 suggests that commercial trucking services are fairly widely available throughout Alberta and are suitable for hauling a broad range of farm products and inputs. Respondents were also asked to give their reasons for using commercial trucking. Limited size of farm vehicles was mentioned by 46 respondents, time constraints by 39, cost considerations by 20 and other reasons by 25. These other reasons included such things as convenience, poor reliability of farm vehicles and lack of specialized equipment. Respondents were allowed to give more than one answer to this question.

In an attempt to verify and further explore the reasons for using commercial trucking, the correlation between this use and a number of other factors was investigated. These factors were: a) the size of the largest truck on each farm, b) the average total cost per kilometre of farm truck use, c) the average age of the farm's trucks, and d) the average distance from the farm to elevators, feed mills and livestock markets. The use of commercial trucking might be expected to be inversely correlated with the size of the largest truck on a farm (since small equipment was given as a reason for using commercial trucking by some respondents), and directly correlated with the other three factors mentioned. There was little evidence of correlation between the use of commercial trucking and these factors. Calculated correlation coefficients ranged from - 0.19 to 0.14, with low levels of statistical significance.

While this correlation analysis did not provide much information on the reasons for using commercial trucking, there are other approaches which might be used to analyse this issue more successfully. Other factors related to farms and farm trucks could be checked, as could supply related factors such as the availability and price of commercial trucking.

As mentioned at the beginning of this section, the reason for investigating the use of commercial trucking by farmers is to determine the degree to which it is a substitute for farm trucking. As an economic substitute, commercial trucking will increase the price sensitivity of farm fuel demand. This, in turn, will reduce the impact of fuel price changes on farm trucking costs.

Information from this study showed that approximately one half of the respondents use commercial trucks and slightly more than 20 per cent of these respondents mentioned cost as a factor in their choice. A tentative conclusion is that although this type of service is used, particularly in the shipment of some products, commercial trucking is not a close economic substitute for farm trucking and the relative demand for one trucking service is not very sensitive to the price of the other. This would therefore reduce the flexibility of fuel demand in response to price changes and increase the impact of such changes on farm costs and net returns. Further investigation of the demand for farm truck fuel would be very helpful to confirm or adjust these rather tentative conclusions.

SECTION VI

GOVERNMENT ASSISTANCE FOR FARM FUEL AND OPPORTUNITIES FOR CONSERVATION

A. Government Assistance

Farm production is an integral part of the food system and is very dependent on energy. In Canada, farm production accounts for about 18 per cent of the food system energy use in both direct and indirect or embodied forms but only about 3 per cent of the total direct energy in the economy. Alberta farmers use about 15.5 per cent of the gasoline and 17.4 per cent of the diesel fuel consumed in the province. Liquid fuel is one of the key input factors in farm production.

Before 1973, liquid fuel prices were considerably lower and the farmers were engaged in relatively inexpensive, energy-intensive farming practices which gave agricultural products a competitive price on the world market. But in 1973, the Organization of Petroleum Exporting Countries (OPEC) initiated increases in world oil prices which have had world-wide economic repercussions. Farming, which is heavily dependent on liquid fuels also felt the price-squeeze. The Provincial Government, realizing that escalating fuel prices would create an unjust burden for the farming community in Alberta, decided to shelter farmers against such price increases, and on May 1, 1974, introduced the Alberta Farm Fuel Distribution Allowance (AFFDA) on gasoline, diesel and heating oil. The rate of assistance under the above program has been as follows:

Effective Date	Rate of Assistance
May 1, 1974	5 cents per gallon (1.01 cents per litre)
Sept. 1, 1975	8 cents per gallon (1.76 cents per litre)
April 1, 1978	12 cents per gallon (2.64 cents per litre)
April 23, 1982	31.8 cents per gallon (7.0 cents per litre)

Assistance under this program is passed on to the farmer at the time of fuel purchase. A major objective of this program is to assist

producers in meeting part of the increasing production costs as a result of price increases in the liquid fuels.

Despite the provincial assistance under the AFFDA and no provincial tax on marked gasoline used in farming operations, net farm fuel prices in Alberta have increased significantly during the last decade. Table 16 below shows the increases in net farm fuel prices from 1972 to 1982.

Table 16 NET FARM FUEL PRICE INCREASES, 1972 TO 1982

Year	Purple Gas	Diesel Fuel
	cents per gallon (litre)	cents per gallon (litre)
1972	24.2 (5.3)	20.7 (4.5)
1974	34.6 (7.6)	31.2 (6.8)
1976	37.5 (8.2)	35.0 (7.7)
1978	50.0 (11.0)	48.0 (10.5)
1980	72.6 (15.9)	64.6 (14.2)
1982	128 (28.1)	125 (27.4)

Besides the Provincial Farm Fuel Distribution Allowance Program, the Federal Government has also assisted farmers and commercial users of gasoline by refunding excise tax on gasoline. On June 23, 1975, the Federal Government introduced an excise tax of 10 cents per gallon (2.2 cents per litre) on all gasoline but allowed farmers and commercial users to obtain a refund of this tax upon application. This tax rebate is now equal to 1.5 cents per litre.

B. Opportunities for Conservation

Farmers should consider the opportunities to conserve energy and reduce their dependence upon non-renewable energy. The real challenge in farming is to identify and adopt energy conservation measures which would maintain productivity and profitability.

Agriculture production can conserve energy in many areas without risking large capital investments in energy-efficient equipment. Major energy conservation areas in farming can be identified as transportation, powered farm equipment, crop production, crop drying, irrigation, special applications, greenhouses, and livestock production.

Opportunities for energy conservation in farming have been the subject of several studies (selected studies are listed in the bibliography) undertaken by the Provincial and Federal Governments, and private consultants. This report will not discuss these opportunities in detail, as its scope is limited to the use of energy in farm trucks. An attempt is made, however, to identify energy conservation measures for farm trucks which are not difficult to adopt.

Several studies have estimated that more than 50 per cent of the gasoline used by farmers is consumed in trucks and cars. It has been suggested that improved operation and proper maintenance of farm trucks and cars plus replacement with more energy efficient could save at least 30 per cent of the gasoline used by Alberta farmers for transportation, or approximately 100 million litres of gasoline per year (Jensen Engineering, p. 39). However, to achieve this goal will require several years because existing vehicles will not be replaced simply for better fuel economy.

Researchers have recommended several other energy conservation measures which are simple to follow and require very little or no investment. Energy conservation measures outlined below can result in considerable energy cost savings to farmers (Alberta Agriculture, p. 19):

i Shop for energy efficient vehicles.

ii Consider diesel power, especially in larger trucks.

iii Don't buy unnecessary options. Automatic transmissions, air conditioners and power equipment all require energy. Cruise control, however, can save energy.

iv Keep engines well tuned. Points, plugs, condenser, carburetor, valve clearance and air filters should be checked regularly.

v Shut-off idling engines.

vi Reduce unnecessary trips. Increased payload.

vii Keep tires at recommended pressure, underinflation of only 20 per cent increases fuel consumption by 16 per cent.

viii Consider the use of energy saving instrumentation, such as fuel monitors.

ix Use automatic timers on block heaters (3 hours is just as effective as all night).

SECTION VII

IMPACT OF CHANGES IN AGRICULTURAL TRANSPORTATION POLICY ON FUTURE USES OF FARM TRUCKS

The extensive Prairie railway network was built during the nineteenth and twentieth centuries as a result of expansion of the railway branch line network. The railway has been the most common mode of transportation for agricultural commodities throughout the Prairies, specifically the movement of grain from country elevator to processors, to east and west coast ports for export purposes and/or to central storage facilities. Moreover, the railroad played a dominant role in extending the area of settlement in the Prairies. Later, farm and commercial truck transportation developed as a "feeder" bringing agricultural products from production areas to the rail sites.

Since the late sixties, the railways have been losing large sums of money on some of the branch lines because of increasing maintenance costs and decreasing in traffic volume. The railways considered abandoning some of the branch lines but the Federal Government brought in a branch line subsidy program which kept these branch lines in use. In the seventies, several commissions investigated the railway's costs and revenues for grain traffic and recommended that some of the branch lines be abandoned to reduce Federal branch line subsidy and losses to the railways. Abandonment of light density rail lines and consolidation of country elevator facilities prompted a change in the agricultural transportation policy.

With the extensive network of country elevators and branch lines in place, the farm trucks were hauling grain for an average distance of 17.9 kilometres (11.1 miles) in Alberta (Chaudhary, p. 25). Under the new transportation policy, the Canadian Transport Commission has authorized the railways to abandon some of the uneconomical branch lines on the Prairies which could result in considerable savings in the Federal branch line subsidy and railway losses. However, branch line abandonment and subsequent closure of country elevators has created some problems for grain farmers as they have to haul grain longer distances than before. Under these conditions, the producers might have to truck grain on

average another 5 to 8 kilometres (3 to 5 miles), increasing the average haul distance from 17.9 kilometres (11.1 miles) to 24.1 kilometres (15 miles). In some areas of the province, the producers may have to haul their grain as much as 48 to 64.4 kilometres (30 to 40 miles) as a result of branch line abandonment and closure of country elevators. With the increase in grain hauling distance, smaller farm trucks will not be economical and such hauls have to be undertaken either with bigger farm trucks or commercial trucks.

In Section II of this report, under farm uses of truck, it was observed that the use of trucks in crop-related activities ranges from 10 per cent in lighter weight categories to more than 79 per cent in heavier weight classes. It is presumed that a major portion of the above use was for hauling grain. With the above changes in the transportation system, farmers are encouraged to use larger trucks for transporting grain or engage commercial truckers for long distance hauling. A comparison of commercial and farm truck costs shows that for average hauling distances greater than 29 kilometres (18 miles), commercial trucking is less expensive than farm truck, because of net payload. For example, at 50 kilometres (30 miles), the commercial truck rate is 25 per cent cheaper than farm truck costs. Therefore, a trend might develop in the purchase of relatively bigger trucks and increase the use of commercial trucks. It could be anticipated that there would be a considerable decrease in the use of small farm trucks for longer hauls. Smaller farm trucks will still be used for on-farm purposes and for off-farm transportation and light hauling.

With the proposed reforms in the Statutory (Crow's Nest Pass) freight rates on grain, farmers would have to strive to lower their transportation bill for deliveries to country elevators and this can be only achieved through the use of bigger farm trucks and/or commercial trucks. The farmers may also consider joint ownership of bigger trucks. Moreover, the farmers could develop other farm production efficiencies to meet the increasing transportation costs.

SECTION VIII

SUMMARY AND CONCLUSIONS

The demand for fuel for farm trucking is related to the characteristics of farm trucks and uses to which they are put. Demand is also related to the relative cost of fuel for trucking and to the availability of substitutes such as commercial trucking. This report presents information on each of these factors.

There were approximately 179 thousand registered farm trucks in Alberta in 1982-83, of which 60 per cent were in the 0 - 5000 kg gross vehicle weight range ("½ to 1 ton" sizes). These smaller trucks are used largely to haul farm supplies, while larger trucks are used mainly for hauling crops (grain, hay, etc.). Smaller trucks, as expected, have a higher fuel efficiency than large trucks. The weighted average efficiency in the 0 - 5000 kg range was 14 miles per gallon for trucks using gasoline, compared to 7 miles per gallon for gasoline trucks over 10,000 kg. This relationship would be offset somewhat, if efficiency were measured in terms of fuel use and payload.

It was estimated in this study that the annual consumption of gasoline in farm trucking in 1981-82 was approximately 460 million litres, while diesel consumption was 27 million litres or more. These amounts compare closely with the 94 per cent of farm trucks reported in this study as using gasoline and approximately 6 per cent using diesel. A shift toward increased use of diesel in farm trucking in the future is expected as a result of the lower cost of diesel fuel and higher diesel fuel efficiency. This study found that fuel costs make up a significant proportion of the costs of farm truck operation. Fuel accounts for approximately one third of the total trucking costs and close to two thirds of the cash or variable costs. Although it was not possible to determine the exact nature of the demand curve from the information gathered in this study, it can be assumed that for farm trucks in general, the price of fuel will have a significant effect on the level of fuel demanded, at least in the long run. As the price of fuel rises, farmers will have considerable incentive to look for conservation techniques or for substitutes for farm trucking.

In the short run farmers will have less opportunity to adjust to changes in fuel prices through conservation. While some fuel conservation measures, as outlined in Section VI, can be undertaken fairly simply, the use of more fuel-efficient farm trucks will be delayed until new vehicles are purchased. Farmers may therefore require assistance during periods of rising energy costs, though this assistance will be more important in the short run than in the long run. In other words, policies and programs which aid the farmer in adjusting to higher prices, rather than permanently isolating him from those prices, will be beneficial.

Approximately 50 per cent of the respondents use commercial trucking and slightly more than 20 per cent of these respondents mentioned cost as a factor in this choice. It could be concluded that although this type of service is used, particularly in the shipment of some products, commercial trucking is not a close economic substitute for farm trucking in terms of the price sensitivity of the relative demand for each. This would tend to reduce the flexibility of fuel demand in response to price changes and increase the impact of those changes on farm costs and net returns.

Commercial trucking provides a more direct substitute for farm trucking for certain commodities. Forage and cattle producers had a relatively higher use of commercial trucking services. In these cases, convenience or specialized equipment may be important factors in the decision to use commercial trucking. As discussed in Section VII, the changes in Canadian agricultural transportation policy which are currently taking place may mean longer average hauling distances and higher rail freight rates. These changes will favour the use of commercial trucks as a substitute for farm trucks. Policies which promote the availability and competitiveness of commercial trucking will reduce the adverse effect of these changes on farmers.

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APPENDIX

Dear Farmer:

Alberta AGRICULTURE

As we all know, energy prices have increased rapidly in recent years and are likely to continue to rise in the future. Higher energy prices will put new pressure on farmers and the rest of the agriculture industry to make adjustments to remain viable and competitive.

This questionnaire has been prepared by the Production Economics and Resource Economics Branches of Alberta Agriculture. Its objective is to gather information on energy use in farm trucking. We would appreciate your cooperation in providing answers that are accurate and complete. (Please provide best estimate if exact figures are not known.)

A self-addressed, stamped envelope is enclosed to return your completed questionnaire. Thank you very much for your prompt response.

OFFICE USE ONLY
R.N. ____
01
REG. ____

1. Nearest town/city to your farm: _____

2. Please complete the following table with information on each of your farm trucks, including pickups. If necessary, use a seperate sheet for additional trucks.

Item	Truck 1	Truck 2	Truck 3	Truck 4	Truck 5
a. Model year					
b. Year purchased					
c. Purchase price					
d. Gross weight (kg)					
e. Type of fuel used (gas or diesel)					
f. Estimated miles per gallon					
g. Type of license (farm, P.S.V., etc.)					
h. Total mileage on vehicle now (miles)					
i. Average mileage per year (miles)					
j. Approximate % of annual mileage for hauling:					
i. crops %					
ii. livestock %					
iii. farm supplies %					
iv. custom hauling %					
v. non-farm use %					
k. Annual cost of:					
i. license $					
ii. insurance $					
iii. fuel $					
iv. maintenance and repairs $					
v. other $					
l. Approximately how many miles are driven annually on your farm (that is, off public roads)					

3. Major enterprise: (please check)

_____ a. grains and oilseeds
_____ b. forages
_____ c. specialty crops
_____ d. cattle
_____ e. dairy
_____ f. hogs
_____ g. poultry

4. Distance from your farm to the following services. (Ignore those which you do not patronize. List more than one distance if more than one location is used.)

a. elevator _____ miles
b. seed plant _____ miles
c. feed mill _____ miles
d. livestock market _____ miles
e. farm supplies _____ miles
f. other (please specify)
_____ _____ miles
_____ _____ miles

02 03 04 05 06 07 08 09 10 11

5. Do you use the services of a custom hauler or commercial trucker? _____ Yes _____ No

If yes, reasons for hiring custom hauler (please check)

_____ a. smaller equipment on the farm

_____ b. no time

_____ c. cheaper

_____ d. other (please specify) _____

If yes, please give name, city/town, and product hauled.

Name	Location	Product
_____	_____	_____
_____	_____	_____
_____	_____	_____